RTD Pit Leak Detectors

The Challenge

Above – leak detectors are located through shielding surface openings to detect leakage on the floor surface below. Left – leak detector element sensor and cable.

Hanford Tank Farm facilities include several hundred valve pits, diversion boxes, clean-out boxes and miles of underground piping for the transfer of radioactive waste. A 30-year-old Hanford leak detector design is currently used to provide alarm indication if a leak occurs during a waste transfer. Each pit or box contains a leak detector. The design was generated at Hanford and the leak detectors were assembled onsite because they were not commercially available. Each leak detector unit has many components, any one of which could create a system failure.

The leak detection system must be accurate and reliable. To ensure a clean operating environment for the workers, a fast leak detection response time is necessary. Any leakage of radioactive waste can have dose consequences for workers and, in some cases, the waste may be permanently absorbed into the concrete surfaces if not cleaned and/or rinsed.

Current Approach

The active baseline leak detection systems utilize a sensor head with two probes. As waste or water comes into contact with the two probes in a pit or a diversion box, the material provides an electrical pathway for the sensing circuit to be completed. The sensing pathway must be intrinsically safe due to flammable gas concerns. The existing system requires a high degree of maintenance. In addition, false alarms from rainwater intrusion and component failures have degraded the reliability of this critical system. A significant effort (operations, maintenance and engineering) is required to maintain this site-wide detection system.

New Technology

The Cross-Site Transfer System Project design included a proven technology using a Resistance Temperature Device (RTD) leak detection system. The sensing head has two RTDs; one is the active unit while the other is the reference unit. The detector electronics operate on a simple circuit comparison method. When the sensor head becomes wet, the difference between the two sensors is

Benefits and Features

- Reliable and repeatable performance
- Commercially available off-the-shelf equipment
- Low maintenance
- Intrinsically safe operation

almost non-existent. When the sensor head is dry there is a large difference between the two sensor readings. The detectors are stable and the sensing of liquid requires less than 60 seconds to respond to a leak. The detector's performance is predictable and repeatable.

The Diversion Box (Building 6241-A) and Vent Station (Building 6241-V) both have lined floors that are sloped towards a sump. The sump in each building has redundant RTD leak detectors that operate in support of the Cross-Site transfer line activities. The RTD detectors provide a shutdown of the cross-site transfer pump upon detection of a leak.

The RTD sensors and electronics units are used in various Nuclear Power Generating Stations throughout the United States with great success. This technology has now been applied within the River Protection Project and may have application elsewhere within the Department of Energy complex.

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